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National Eutrophication Survey, Corvallis, Oreg

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NATIONAL EUTROPHICATION SURVEY

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16. ABSTRACT

Annual total phosphorus and total nitrogen loadings to the lake were estimated and subdivided according to either point or non-point source origin. An assessment of the lake's trophic condition and limiting nutrient is also provided. All data collected by the U.S.E.P.A. National Eutrophication Survey during the one year study of the lake and its tributaries are included in the report.

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REPORT

ON

HERRINGTON LAKE

BOYLE, GARRARD, AND MERCER COUNTIES

KENTUCKY

EPA REGION IV

WORKING PAPER NO. 353

WITH THE COOPERATION OF THE

KENTUCKY DEPARTMENT FOR NATURAL RESOURCES AND ENVIRONMENTAL CONTROL

AND THE

KENTUCKY NATIONAL GUARD

JUNE, 1977

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FOREWORD

The National Eutrophication Survey was initiated in 1972 in response to an Administration commitment to investigate the nationwide threat of accelerated eutrophication to freshwater lakes and reservoirs.

OBJECTIVES

The Survey was designed to develop, in conjunction with state environmental agencies, information on nutrient sources, concentrations, and impact on selected freshwater lakes as a basis for formulating comprehensive and coordinated national, regional, and state management practices relating to point-source discharge reduction and non-point source pollution abatement in lake watersheds.

ANALYTIC APPROACH

The mathematical and statistical procedures selected for the Survey's eutrophication analysis are based on related concepts that:

a. A generalized representation or model relating sources, concentrations, and impacts can be constructed.

b. By applying measurements of relevant parameters associated with lake degradation, the generalized model can be transformed into an operational representation of a lake, its drainage basin, and related nutrients.

c. With such a transformation, an assessment of the potential for eutrophication control can be made.

LAKE ANALYSIS

In this report, the first stage of evaluation of lake and watershed data collected from the study lake and its drainage basin is documented. The report is formatted to provide state environmental agencies with specific information for basin planning [§303(e)], water quality criteria/standards review [§303(c)], clean lakes [§314(a,b)], and water quality monitoring [§106 and §305(b)] activities mandated by the Federal Water Pollution Control Act Amendments of 1972.

Beyond the single lake analysis, broader based correlations between nutrient concentrations (and loading) and trophic condition are being made to advance the rationale and data base for refinement of nutrient water quality criteria for the Nation's fresh water lakes. Likewise, multivariate evaluations for the relationships between land use, nutrient export, and trophic condition, by lake class or use, are being developed to assist in the formulation of planning guidelines and policies by EPA and to augment plans implementation by the states.

ACKNOWLEDGEMENT

The staff of the National Eutrophication Survey (Office of Research & Development, U. S. Environmental Protection Agency) expresses sincere appreciation to the Kentucky Department for Natural Resources and Environmental Protection for professional involvement, to the Kentucky National Guard for conducting the tributary sampling phase of the Survey, and to those Kentucky wastewater treatment plant operators who voluntarily provided effluent samples.

Harold Snodgrass, former Director, and Mercer M. Peters of the Division of Water Quality provided invaluable lake documentation and counsel during the Survey; and the staff of the Division reviewed the preliminary reports and provided critiques most useful in the preparation of this Working Paper series.

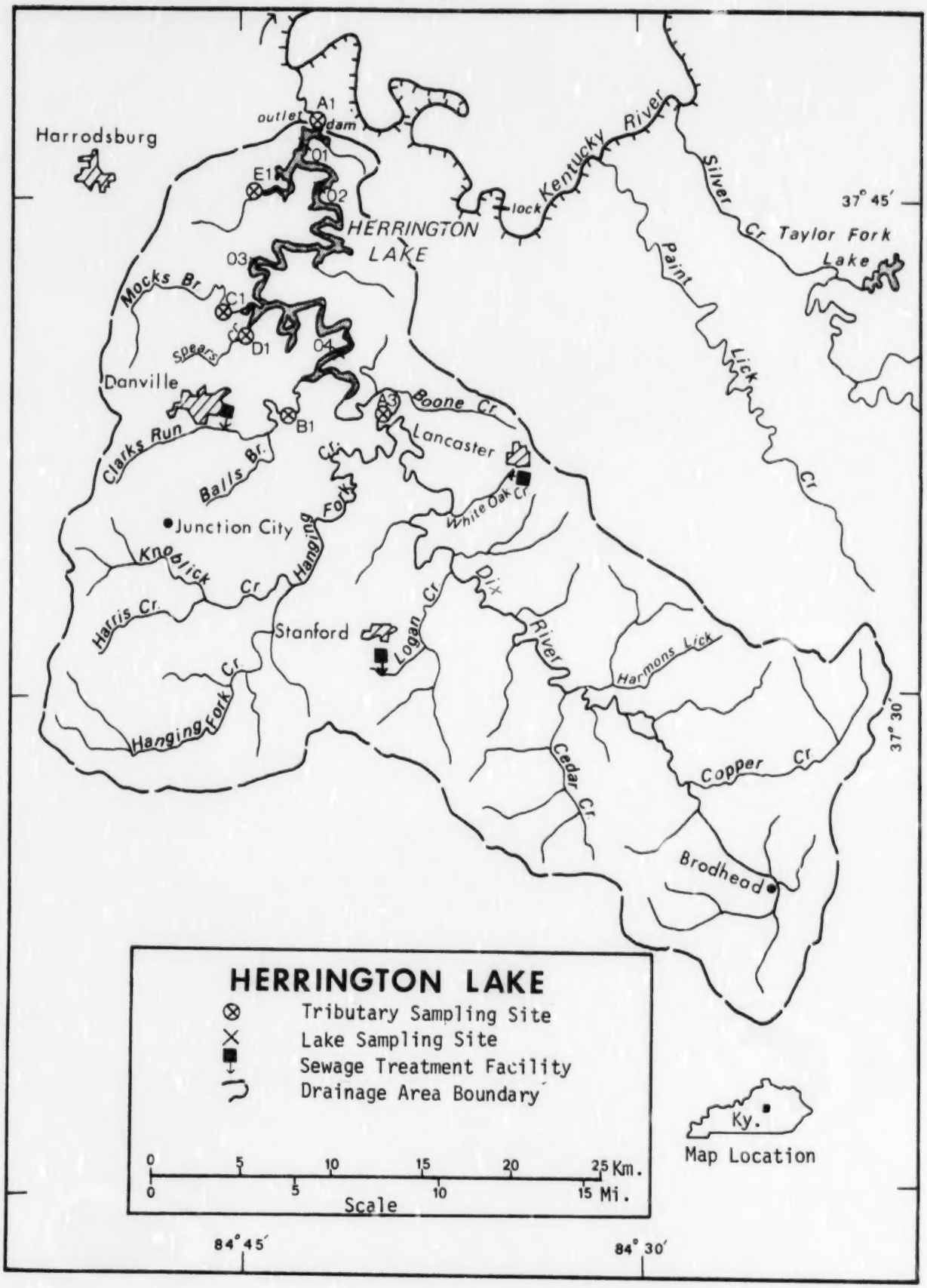
Major General Richard L. Frymire, the Adjutant General of Kentucky, and Project Officers Lt. Colonel Thomas Buyher, Jr., and Lt. Colonel David B. May, who directed the volunteer efforts of the Kentucky National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

NATIONAL EUTROPHICATION SURVEY

STUDY RESERVOIRS

STATE OF KENTUCKY

NAME	COUNTY
Barkley	Lyon, Trigg, KY; Cheatham, Montgomery, Stewart, TN
Barren River	Allen, Barren
Cumberland	Clinton, Pulaski, Russell, Wayne
Dale Hollow	Clinton, Cumberland, KY; Clay, Overton, Pickett, TN
Herrington	Boyler, Garrard, Mercer
Kentucky	Calloway, Livingston, Lyon, Marshall, Trigg, KY; Benton, Decatur, Henry, Houston, Humphreys, Perry, Stewart, TN


Harrodsburg
outlet
A1
dam
E1
C1
C2
HERRINGTON
LAKE
lock
Kentucky River
Silver Cr
Taylor Fork
Lake
37° 45'
03
Mocks Br
C1
Speers
D1
04
Paint Lick Cr
Danville
B1
Boone Cr
Clarks Run
Lancaster
Balls Br.
Junction City
Hanging Fork
White Oak Cr
Knoblick Cr
Harris Cr.
Stanford
Logan Cr
Dix River
Harmons Lick
Hanging Fork Cr
Cedar Cr
Copper Cr
37° 30'
Brodhead
HERRINGTON LAKE
Tributary Sampling Site
Lake Sampling Site
Sewage Treatment Facility
Drainage Area Boundary
0 5 10 15 20 25 Km.
0 5 10 15 Mi.
Scale
Ky.
Map Location
84° 45'
84° 30'

HERRINGTON LAKE

STORET NO. 2103

I. CONCLUSIONS

A. Trophic Condition:

Survey data indicate that Herrington Lake is eutrophic; i.e., well-supplied with nutrients and quite productive. Whether nutrient enrichment is beneficial or deleterious depends on the actual or potential effect on the uses of the lake. In this regard, personnel of the Kentucky Department for Natural Resources and Environmental Protection indicate additional study is needed to determine whether the beneficial uses of Herrington Lake are impaired.

This water body ranked last in overall trophic quality when the five Kentucky reservoirs sampled in 1973 were compared using a combination of six parameters*. All of the other reservoirs had less median total phosphorus, median orthophosphorus, median inorganic nitrogen, and mean chlorophyll a. Two of the water bodies had greater mean Secchi disc transparency.

Marked depression or depletion of dissolved oxygen with depth and chlorophyll a levels at all sampling sites in May and August and at station 4 in October indicate lake deterioration.

B. Rate-Limiting Nutrient:

The algal assay results indicate Herrington Lake was limited

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* See Appendix A.

by phosphorus at the time the sample was collected (05/26/73). These results are substantiated by the lake data obtained at that time; i.e., the mean inorganic nitrogen to orthophosphorus ratio was 16 to 1. At the other two sampling times (08/20/73 and 10/25/73), the lake data indicate that nitrogen was the limiting nutrient; i.e., the mean inorganic nitrogen to orthophosphorus ratios were 8 to 1 and less.

C. Nutrient Controllability:

1. Point sources--The phosphorus contribution of known point sources amounted to 26.7% of the total phosphorus load reaching Herrington Lake during the sampling year. The wastewater treatment facilities at Danville, Lancaster, Stanford, and Herrington Haven collectively contributed 23.7% of the total. The untreated wastes from Burgin and Junction City together accounted for 3.0% of the load.

The phosphorus loading of 9.24 g/m^2 measured during the sampling year is seven times that proposed by Vollenweider (Vollenweider and Dillon, 1974) as a eutrophic loading (see page 14). Even complete removal of phosphorus at the listed point sources would only reduce the loading to 6.78 $g/m^2/yr$ (over five times the eutrophic level), and unless a significant portion of the non-point load can also be reduced, it does not seem likely that point-source removal would result in a significant improvement in the trophic condition of the lake.

2. Non-point sources--Non-point sources accounted for 73.3% of the total phosphorus input to the lake. The Dix River and Clarks Run contributed 29.7% and 28.2% of this total, respectively. The remaining three tributaries contributed a combined load amounting to 10.0% of the total. The ungaged tributaries contributed an estimated 5.1% of the total phosphorus load.

Clarks Run, Mocks Branch, and Spears Creek had export rates which were extremely high (see page 13) as compared to the tributaries of Cumberland Lake*; e.g., Indian Creek (10 $kg/km^2/yr$), Meadow Creek (16 $kg/km^2/yr$), and the Laurel River (24 $kg/km^2/yr$). The high rates of the Herrington Lake tributaries may be due to unknown point sources impacting those streams.

* See Working Paper No. 351.

II. LAKE AND DRAINAGE BASIN CHARACTERISTICS†

A. Morphometry††:

1. Surface area: 11.90 kilometers^2.
2. Mean depth: 23.9 meters.
3. Maximum depth: >61 meters.
4. Volume: 284.410 x 10^6 m^3.
5. Mean hydraulic retention time: 196 days.

B. Tributary and Outlet:
(See Appendix C for flow data)

1. Tributaries -

Name	Drainage area (km^2)*	Mean flow (m^3/sec)*
Dix River	823.6	12.15
Clarks Run	73.0	0.98
Mocks Branch	42.5	0.56
Spears Creek	19.8	0.26
Cane Run	25.3	0.33
Minor tributaries & immediate drainage -	140.9	2.50
Totals	1,125.1	16.78**

2. Outlet -

Dix River	1,137.0***	16.78

C. Precipitation****:

1. Year of sampling: 126.9 centimeters.
2. Mean annual: 115.8 centimeters.

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† Table of metric conversions--Appendix B.
†† Jett, 1974.
* For limits of accuracy, see Working Paper No. 175, "Survey Methods, 1973-1976".
** Sum of inflows adjusted to equal outflow.
*** Includes area of lake.
**** See Working Paper No. 175.

III. WATER QUALITY SUMMARY

Herrington Lake was sampled three times in 1973 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from a number of depths at four stations on the lake (see map, page v). During each visit, a single depth-integrated (4.6 m to surface) sample was composited from the stations for phytoplankton identification and enumeration; and during the first visit, a single 18.9-liter depth-integrated sample was composited for algal assays. Also each time, a depth-integrated sample was collected from each of the stations for chlorophyll a analysis. The maximum depths sampled were 61.0 meters at station 1, 55.8 meters at station 2, 44.2 meters at station 3, and 9.1 meters at station 4.

The sampling results are presented in full in Appendix D and are summarized in the following table.

A. SUMMARY OF PHYSICAL AND CHEMICAL CHARACTERISTICS FOR HERRINGTON LAKE
STORET CODE 2103

PARAMETER	1ST SAMPLING (5/26/73) 4 SITES RANGE	MEAN	MEDIAN	2ND SAMPLING (8/20/73) 4 SITES RANGE	MEAN	MEDIAN	3RD SAMPLING (10/25/73) 4 SITES RANGE	MEAN	MEDIAN
TEMP (C)	7.0 - 23.9	16.4	17.5	5.4 - 28.1	21.4	24.7	6.8 - 21.4	18.1	20.6
DISS OXY (MG/L)	2.2 - 16.0	7.1	6.5	0.0 - 8.0	2.0	0.2	0.4 - 6.2	2.5	2.8
CNDCTVY (MCROMO)	****** -**********			201. - 318.	242.	236.	205. - 282.	232.	230.
PH (STAND UNITS)	7.4 - 9.2	8.1	7.9	6.4 - 7.9	7.1	7.0	7.0 - 8.0	7.5	7.4
TOT ALK (MG/L)	78. - 117.	103.	106.	75. - 150.	103.	98.	98. - 144.	108.	106.
TOT P (MG/L)	0.027 - 0.231	0.090	0.079	0.028 - 0.412	0.126	0.087	0.046 - 0.445	0.113	0.074
ORTHO P (MG/L)	0.009 - 0.110	0.054	0.054	0.012 - 0.214	0.073	0.056	0.012 - 0.196	0.063	0.042
NO2+NO3 (MG/L)	0.180 - 1.590	0.795	0.815	0.040 - 1.400	0.332	0.120	0.020 - 1.020	0.145	0.040
AMMONIA (MG/L)	0.030 - 0.260	0.094	0.065	0.040 - 1.620	0.280	0.090	0.040 - 0.980	0.144	0.060
KJEL N (MG/L)	0.200 - 1.000	0.480	0.450	0.300 - 2.700	0.863	0.700	0.200 - 1.800	0.587	0.450
INORG N (MG/L)	0.220 - 1.630	0.889	0.950	0.080 - 1.740	0.612	0.560	0.070 - 1.060	0.288	0.100
TOTAL N (MG/L)	0.750 - 1.890	1.275	1.265	0.540 - 2.820	1.195	1.060	0.220 - 1.840	0.732	0.710
CHLRPYL A (UG/L)	6.1 - 26.5	17.6	18.9	8.0 - 11.0	9.2	9.0	1.7 - 64.6	17.8	2.5
SECCHI (METERS)	0.9 - 1.5	1.1	1.0	1.0 - 2.7	1.6	1.3	0.5 - 2.7	1.6	1.7

B. Biological characteristics:

1. Phytoplankton -

Sampling Date	Dominant Genera	Algal Units per ml
05/26/73	1. Flagellates	4,970
	2. *Fragilaria sp.*	4,970
	3. *Scenedesmus sp.*	155
	4. *Stephanodiscus sp.*	133
	5. *Asterionella sp.*	89
	Other genera	289
	Total	10,606
08/20/73	1. *Raphidiopsis sp.*	1,711
	2. Flagellates	1,498
	3. *Stephanodiscus sp.*	642
	4. *Oscillatoria sp.*	585
	5. *Synedra sp.*	313
	Other genera	768
	Total	5,517
10/25/73	1. Flagellates	7,501
	2. *Melosira sp.*	1,162
	3. *Stephanodiscus sp.*	563
	4. *Cyclotella sp.*	246
	5. *Merismopedia sp.*	211
	Other genera	741
	Total	10,424

2. Chlorophyll *a* -

Sampling Date	Station Number	Chlorophyll *a* (µg/l)
05/26/73	1	21.7
	2	26.5
	3	6.1
	4	16.2
08/20/73	1	9.4
	2	8.6
	3	8.0
	4	11.0
10/25/73	1	2.0
	2	1.7
	3	3.1
	4	64.6

C. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked -

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum yield (mg/l-dry wt.)
Control	0.032	0.856	8.1
0.050 P	0.082	0.856	13.5
0.050 P + 1.0 N	0.082	1.856	18.5
1.0 N	0.032	1.856	7.1

2. Discussion -

The control yield of the assay alga, Selenastrum capricornutum, indicates that the potential primary productivity of Herrington Lake was high at the time the sample was collected (05/26/73). Also, the significant increase in yield with the addition of orthophosphorus indicates phosphorus limitation. Note that the addition of nitrogen alone resulted in a yield not significantly different from that of the control.

The lake data also indicate phosphorus limitation at that time; i.e., the mean inorganic nitrogen/orthophosphorus ratio was 16/1. At the other sampling times (08/20/73 and 10/25/73), the lake data indicate that nitrogen was the limiting nutrient; i.e., the mean inorganic nitrogen/orthophosphorus ratios were 8/1 and less.

IV. NUTRIENT LOADINGS
(See Appendix E for data)

For the determination of nutrient loadings, the Kentucky National Guard collected monthly near-surface grab samples from each of the tributary sites indicated on the map (page v), except for the month of May when two samples were collected at most of the sites. Sampling was begun in March, 1973, and was completed in April, 1974.

Through an interagency agreement, stream flow estimates for the year of sampling and a "normalized" or average year were provided by the Kentucky District Office of the U.S. Geological Survey for the tributary sites nearest the lake.

In this report, nutrient loads for sampled tributaries were determined by using a modification of a U.S. Geological Survey computer program for calculating stream loadings*. Nutrient loads shown are those measured minus point-source loads, if any.

Nutrient loadings for unsampled "minor tributaries and immediate drainage" ("ZZ" of U.S.G.S.) were estimated using the nutrient exports of the Dix River at station D-3, in kg/km^2/year, and multiplying by the ZZ area in km^2.

The operators of the Lancaster, Stanford, and Danville wastewater treatment plants provided monthly effluent samples and corresponding flow data. The operator of the Herrington Haven State Hospital wastewater treatment plant did not participate in the sampling program, and nutrient loads were estimated at 1.134 kg P and 3.401 kg N/capita/

* See Working Paper No. 175.

year. The untreated nutrient loads from Burgin and Junction City were estimated at 1.587 kg P and 4.263 kg N/capita/year.

A. Waste Sources*:

1. Known municipal -

Name	Pop. Served	Treatment	Mean Flow (m^3/d)	Receiving Water
Lancaster	3,230	trickling filter	844.1	White Oak Creek
Stanford	2,474	trickling filter	1,327.6	Logan Creek
Danville	11,542	trickling filter	6,056.6	Clarks Run
Herrington Haven State Hospital**	800	ext. aer.	302.8	Herrington Lake
Junction City**	1,046	none	395.9	Knoblick Creek
Burgin**	1,002	none	379.3	Unnamed Creek/ Herrington Lake

2. Known industrial - None

* Anonymous, 1971; population served is 1970 Census.
** Flow based on 0.3785 m^3/capita/day.

B. Annual Total Phosphorus Loading - Average Year:

1. Inputs -

Source	kg P/ yr	% of total
a. Tributaries (non-point load) -		
Dix River	32,685	29.7
Clarks Run	30,980	28.2
Mocks Branch	6,570	6.0
Spears Creek	2,555	2.3
Cane Run	1,835	1.7
b. Minor tributaries & immediate drainage (non-point load) -	5,635	5.1
c. Known municipal STP's -		
Lancaster	5,845	5.3
Stanford	4,960	4.5
Danville	14,350	13.1
Herrington Haven	905	0.8
Junction City	1,660	1.5
Burgin	1,590	1.4
d. Septic tanks* -	155	0.1
e. Known industrial - None	-	-
f. Direct precipitation** -	210	0.2
Total	109,935	100.0

2. Outputs -

Lake outlet - Dix River 51,955

3. Net annual P accumulation - 57,980 kg.

* Estimate based on 513 lakeshore dwellings and four camps; see Working Paper No. 175.
** See Working Paper No. 175.

C. Annual Total Nitrogen Loading - Average Year:

1. Inputs -

Source	kg N/ yr	% of total
a. Tributaries (non-point load) -		
Dix River	719,415	61.8
Clarks Run	121,640	10.5
Mocks Branch	70,010	6.0
Spears Creek	23,475	2.0
Cane Run	25,865	2.2
b. Minor tributaries & immediate drainage (non-point load) -	123,145	10.6
c. Known municipal STP's -		
Lancaster	7,880	0.7
Stanford	6,030	0.5
Danville	36,220	3.1
Herrington Haven	2,720	0.2
Junction City	4,460	0.4
Burgin	4,270	0.4
d. Septic tanks* -	5,745	0.5
e. Known industrial - None	-	-
f. Direct precipitation** -	12,845	1.1
Total	1,163,720	100.0

2. Outputs -

Lake outlet - Dix River 1,565,170

3. Net annual N loss - 401,450 kg.

* Estimate based on 513 lakeshore dwellings and four camps; see Working Paper No. 175.
** See Working Paper No. 175.

D. Non-point Nutrient Export by Subdrainage Area:

Tributary	kg P/km^2/yr	kg N/km^2/yr
Dix River	40	874
Clarks Run	424	1,666
Mocks Branch	155	1,647
Spears Creek	129	1,186
Cane Run	73	1,022

E. Yearly Loadings:

In the following table, the existing phosphorus loadings are compared to those proposed by Vollenweider (Vollenweider and Dillon, 1974). Essentially, his "dangerous" loading is one at which the receiving water would become eutrophic or remain eutrophic; his "permissible" loading is that which would result in the receiving water remaining oligotrophic or becoming oligotrophic if morphometry permitted. A mesotrophic loading would be considered one between "dangerous" and "permissible".

Note that Vollenweider's model may not be applicable to water bodies with short hydraulic retention times.

	Total Phosphorus		Total Nitrogen	
	Total	Accumulated	Total	Accumulated
grams/m^2/yr	9.24	4.87	97.8	loss*

Vollenweider phosphorus loadings ($g/m^2/yr$) based on mean depth and mean hydraulic retention time of Herrington Lake:

"Dangerous" (eutrophic loading)	1.28
"Permissible" (oligotrophic loading)	0.64

* There was an apparent loss of nitrogen during the sampling year. This may have been due to nitrogen fixation in the lake, solubilization of previously sedimented nitrogen, recharge with nitrogen-rich ground water, or unsampled point sources discharging directly to the lake. Whatever the cause, a similar nitrogen loss has occurred at Shagawa Lake, Minnesota, which has been intensively studied by EPA's former National Eutrophication and Lake Restoration Branch (Malueg et al., 1975).

V. LITERATURE REVIEWED

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VI. APPENDICES

APPENDIX A

LAKE RANKINGS

LAKE DATA TO BE USED IN RANKINGS

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS P
2101	LAKE CUMBERLAND-	0.016	0.330	432.381	3.805	14.900	0.007
2102	DALE HOLLOW RESERVOIR	0.010	0.270	330.000	3.594	14.800	0.005
2103	HERRINGTON LAKE	0.079	0.550	442.667	14.908	14.900	0.047
2104	KENTUCKY LAKE	0.072	0.520	461.972	9.089	12.600	0.030
2105	BARREN RIVER RESERVOIR	0.027	0.460	452.594	8.216	14.900	0.006

PERCENT OF LAKES #ITH HIGHER VALUES

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500- MEAN SEC	MEAN CHLORA	15- MIN DO	MEDIAN DISS P	INDE NO
2101	LAKE CUMBERLAND	60 (3)	60 (3)	60 (3)	60 (3)	20 (0)	40 (2)	300
2102	DALE HOLLOW RESERVOIR	80 (4)	80 (4)	80 (4)	80 (4)	60 (3)	80 (4)	460
2103	HERRINGTON LAKE	0 (0)	0 (0)	40 (2)	0 (0)	20 (0)	0 (0)	60
2104	KENTUCKY LAKE	20 (1)	20 (1)	0 (0)	20 (1)	80 (4)	20 (1)	160
2105	BARREN RIVER RESERVOIR	40 (2)	40 (2)	20 (1)	40 (2)	20 (0)	60 (3)	220

LAKES RANKED BY INDEX NOS.

RANK	LAKE CODE	LAKE NAME	INDEX NO
1	2102	DALE HOLLOW RESERVOIR	460
2	2101	LAKE CUMBERLAND	300
3	2105	BARREN RIVER RESERVOIR	220
4	2104	KENTUCKY LAKE	160
5	2103	HERRINGTON LAKE	60

APPENDIX B

CONVERSION FACTORS

CONVERSION FACTORS

Hectares x 2.471 = acres

Kilometers x 0.6214 = miles

Meters x 3.281 = feet

Cubic meters x 8.107×10^{-4} = acre/feet

Square kilometers x 0.3861 = square miles

Cubic meters/sec x 35.315 = cubic feet/sec

Centimeters x 0.3937 = inches

Kilograms x 2.205 = pounds

Kilograms/square kilometer x 5.711 = lbs/square mile

APPENDIX C

TRIBUTARY FLOW DATA

TRIBUTARY FLOW INFORMATION FOR KENTUCKY 2/3/75

LAKE CODE 2103 HERRINGTON LAKE

TOTAL DRAINAGE AREA OF LAKE(SQ KM) 1137.0

TRIBUTARY	SUB-DRAINAGE AREA(SQ KM)	NORMALIZED FLOWS(CMS) JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
2103A1	1137.0	27.24	32.51	37.32	25.17	13.90	10.65	10.56	6.46	5.58	4.33	9.34	19.23	16.78
2103A3	823.6	22.99	29.17	30.21	16.88	9.97	6.68	5.83	2.10	1.30	0.62	6.17	14.92	12.15
2103B1	73.0	1.59	2.18	2.63	1.50	1.02	0.48	0.42	0.21	0.15	0.10	0.48	1.10	0.98
2103C1	42.5	0.88	1.25	1.53	0.88	0.59	0.27	0.25	0.12	0.08	0.06	0.28	0.62	0.56
2103D1	19.8	0.40	0.57	0.71	0.40	0.28	0.12	0.11	0.05	0.04	0.03	0.13	0.28	0.26
2103E1	25.3	0.51	0.74	0.91	0.51	0.37	0.16	0.15	0.07	0.05	0.03	0.17	0.37	0.33
2103Z2	143.0	3.20	4.28	5.18	3.00	1.98	0.99	0.85	0.42	0.31	0.22	0.96	2.15	1.95

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 1137.0
SUM OF SUB-DRAINAGE AREAS = 1127.2
TOTAL FLOW IN = 196.22
TOTAL FLOW OUT = 202.30

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
2103A1	3	73	28.32	31	5.66				
	4	73	37.38						
	5	73	45.87	1	36.81	31	36.81		
	6	73	22.63						
	7	73	19.54	3	36.81				
	8	73	7.59	3	5.66				
	9	73	5.78	6	19.82				
	10	73	4.76	3	5.66				
	11	73	20.05	4	7.08				
	12	73	27.35	1	50.97				
	1	74	82.69	5	39.64	20	59.47		
	2	74	24.55	15	11.89				
	3	74	37.94	1	17.84	16	24.35		
	4	74	32.85	2	53.80				
2103A3	3	73	23.47	31	14.38				
	4	73	30.07						
	5	73	38.99	1	15.01	30	44.17		
	6	73	12.66						
	7	73	12.35	3	9.46				
	8	73	0.97	1	3.77	31	0.25		
	9	73	0.09						
	10	73	0.04	2	0.05	31	0.13		
	11	73	21.04						
	12	73	16.57	31	41.63				
	1	74	71.25	5	41.06				
	2	74	11.33						
	3	74	26.73	1	7.19				
	4	74	18.69						

TRIBUTARY FLOW INFORMATION FOR KENTUCKY 2/3/75

LAKE CODE 2103 HERRINGTON LAKE

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
2103B1	3	73	2.07	31	1.27				
	4	73	2.66						
	5	73	3.99	1	1.56	30	4.50		
	6	73	0.91						
	7	73	0.91	3	0.71				
	8	73	0.10	1	0.37	31	0.03		
	9	73	0.01						
	10	73	0.01	2	0.01	31	0.03		
	11	73	1.64						
	12	73	1.22	31	3.06				
	1	74	4.93	31	1.25				
	2	74	0.85						
	3	74	2.32	1	0.62				
	4	74	1.67	2	6.91				
2103C1	3	73	1.19	31	0.74				
	4	73	1.56	29	1.98				
	5	73	2.32	1	0.88	30	2.63		
	6	73	0.51						
	7	73	0.54	3	0.42				
	8	73	0.05	1	0.21	31	0.01		
	9	73	0.01						
	10	73	0.00	2	0.00	31	0.01		
	11	73	0.96						
	12	73	0.68	31	1.70				
	1	74	2.72	31	0.68				
	2	74	0.48						
	3	74	1.36	1	0.37				
	4	74	0.96	2	3.99				
2103D1	3	73	0.57	31	0.34				
	4	73	0.71	29	0.91				
	5	73	1.10	30	1.25				
	6	73	0.23						
	7	73	0.24	3	0.18				
	8	73	0.02	1	0.09	31	0.01		
	9	73	0.00						
	10	73	0.00	2	0.00	31	0.01		
	11	73	0.45						
	12	73	0.31	31	0.79				
	1	74	1.22	31	0.31				
	2	74	0.22						
	3	74	0.62	1	0.17				
	4	74	0.42	2	1.76				

TRIBUTARY FLOW INFORMATION FOR KENTUCKY 2/3/75

LAKE CODE 2103 HERRINGTON LAKE

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
2103E1	3	73	0.71	31	0.42				
	4	73	0.91	29	1.16				
	5	73	1.44	31	1.70				
	6	73	0.31						
	7	73	0.31	3	0.24				
	8	73	0.03	3	0.07				
	9	73	0.00	6	0.01				
	10	73	0.00	3	0.01				
	11	73	0.57	4	0.01				
	12	73	0.40						
	1	74	1.59	5	0.91	20	0.79		
	2	74	0.28	15	0.12				
	3	74	0.79	1	0.21	12	1.78		
	4	74	0.57						
2103ZZ	3	73	4.05						
	4	73	5.35						
	5	73	7.76						
	6	73	1.87						
	7	73	1.81						
	8	73	0.20						
	9	73	0.02						
	10	73	0.01						
	11	73	3.28						
	12	73	2.38						
	1	74	9.91						
	2	74	1.67						
	3	74	4.59						
	4	74	3.34						

APPENDIX D

PHYSICAL and CHEMICAL DATA

STORET RETRIEVAL DATE 75/01/27

210301
37 46 53.0 084 42 34.0
HERRINGTON LAKE
21167 KENTUCKY

11EPALES
3

2111202
0184 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
73/05/26	11	30 0000	22.3		42	270	9.00	94	0.040	1.000	0.320	0.023
	11	30 0004	22.2	13.6		270	8.90	94	0.040	0.800	0.300	0.030
	11	30 0015	19.4	7.2		275	8.20	102	0.120	0.400	0.360	0.014
	11	30 0024	18.0	6.0		285	7.90	110	0.170	0.400	0.530	0.016
	11	30 0045	16.4	6.2		285	7.90	112	0.200	0.400	0.660	0.031
	11	30 0065	14.0	7.0		280	7.90	112	0.180	0.400	0.700	0.048
	11	30 0095	11.9	7.6		275	8.00	110	0.100	0.300	0.860	0.047
	11	30 0130	10.8	6.6		295	7.70	116	0.030	0.200K	1.340	0.076
	11	30 0180	7.0	6.0		285	7.50	117	0.040	0.300	1.530	0.110
73/08/20	12	15 0000	28.0	8.0	40	265	7.90	76	0.070	0.800	0.120	0.019
	12	15 0015	27.5	5.4		274	7.60	78	0.040	0.500	0.050	0.022
	12	15 0037	22.0	0.0		242	7.20	98	0.120	0.500	0.040	0.056
	12	15 0060	18.6			234						
	12	15 0100	16.1			223						
	12	15 0170	10.4	0.1		221	6.90	115	0.300	0.700	0.780	0.123
	12	15 0200	5.4	0.0		208	6.90	127	0.690	1.300	0.150	0.214
73/10/25	10	34 0000	21.2		67	247	8.00	102	0.060	0.700	0.040	0.053
	10	34 0005	21.2	4.8		247	7.90	100	0.050	0.800	0.020	0.042
	10	34 0015	21.4	5.0		244	7.90	100	0.050	0.700	0.020	0.038
	10	34 0030	21.1	4.6		244	7.80	101	0.060	0.700	0.030	0.046
	10	34 0050	20.9	2.8		247	7.70	102	0.080	0.200	0.030	0.052
	10	34 0070	18.1	0.6		214	7.40	102	0.040	0.200K	0.500	0.072
	10	34 0110	15.1	0.6		215	7.40	106	0.040	0.200K	1.020	0.101
	10	34 0150	12.4	0.6		219	7.30	125	0.390	0.600	0.580	0.148
	10	34 0185	6.8	0.6		205	7.30	133	0.810	1.300	0.110	0.196

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 75/01/27

210301
37 46 53.0 084 42 34.0
HERRINGTON LAKE
21167 KENTUCKY

11EPALES 2111202
3 0184 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/05/26	11 30	0000	0.099	21.7
	11 30	0004	0.099	
	11 30	0015	0.042	
	11 30	0024	0.030	
	11 30	0045	0.041	
	11 30	0065	0.056	
	11 30	0095	0.053	
	11 30	0130	0.089	
	11 30	0180	0.150	
73/08/20	12 15	0000	0.087	9.4
	12 15	0015	0.043	
	12 15	0037	0.065	
	12 15	0170	0.123	
	12 15	0200	0.235	
73/10/25	10 34	0000	0.079	2.0
	10 34	0005	0.062	
	10 34	0015	0.059	
	10 34	0030	0.068	
	10 34	0050	0.076	
	10 34	0070	0.081	
	10 34	0110	0.106	
	10 34	0150	0.181	
	10 34	0185	0.445	

STORET RETRIEVAL DATE 75/01/27

210302
37 45 20.0 084 42 12.0
HERRINGTON LAKE
21167 KENTUCKY

11EPALES 2111202
3 0185 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
73/05/26	12 35	0000	22.1		39	220	9.20	91	0.030	0.600	0.200	0.014
	12 35	0005	21.5	16.0		220	9.10	94	0.040	0.700	0.180	0.013
	12 35	0015	19.4	8.8		240	8.60	108	0.040	0.400	0.350	0.009
	12 35	0025	18.0	6.2		260	8.20	112	0.080	0.400	0.510	0.013
	12 35	0050	16.0	6.0		260	7.90	114	0.150	0.400	0.840	0.065
	12 35	0075	13.0	6.6		280	7.90	105	0.070	0.400	0.960	0.060
	12 35	0110	11.6	7.0		280	7.70	108	0.030	0.300	1.260	0.076
	12 35	0150	9.8	6.4		295	7.60	113	0.040	0.300	1.590	0.092
	12 35	0180	7.3	4.4		295	7.40	109	0.040	0.300	1.400	0.096
73/08/20	13 15	0000	28.1	7.6	108	236	7.80	75	0.050	0.900	0.040	0.014
	13 15	0010	27.9			236						
	13 15	0015	26.9	0.8		251	7.20	90	0.040	0.500	0.040	0.022
	13 15	0020	25.2			264						
	13 15	0060	18.5	0.0		222	7.00	101	0.110	0.500	0.490	0.034
	13 15	0100	16.0	0.4		217	6.90	103	0.050	0.300	1.400	0.109
	13 15	0150	13.1			208						
	13 15	0183	7.4	0.2		218	6.70	139	0.850	1.400	0.510	0.214
73/10/25	11 16	0000	21.0		106	230	7.60	98	0.060	0.600	0.040	0.037
	11 16	0010	20.9	4.6		230	7.60	98	0.050	0.300	0.040	0.031
	11 16	0020	20.9	4.6		231	7.60	98	0.040	0.400	0.040	0.030
	11 16	0050	20.9	4.6		230	7.60	99	0.040	0.200	0.040	0.032
	11 16	0070	18.1	0.4		211	7.30	102	0.040	0.300	0.540	0.114
	11 16	0110	15.4	0.6		217	7.20					
	11 16	0150	12.7	0.6		242	7.10	144	0.980	1.200	0.060	0.117
	11 16	0171	7.1	0.6		220	7.20					

STORET RETRIEVAL DATE 75/01/27

210302
37 45 20.0 084 42 12.0
HERRINGTON LAKE
21167 KENTUCKY

11EPALES 2111202
3 0185 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/05/26	12 35	0000	0.053	26.5
	12 35	0005	0.062	
	12 35	0015	0.035	
	12 35	0025	0.027	
	12 35	0050	0.079	
	12 35	0075	0.071	
	12 35	0110	0.078	
	12 35	0150	0.097	
	12 35	0180	0.098	
73/08/20	13 15	0000	0.028	8.6
	13 15	0015	0.032	
	13 15	0060	0.035	
	13 15	0100	0.109	
	13 15	0183	0.294	
73/10/25	11 16	0000	0.052	1.7
	11 16	0010	0.046	
	11 16	0020	0.046	
	11 16	0050	0.047	
	11 16	0070	0.136	
	11 16	0150	0.188	

STORET RETRIEVAL DATE 75/01/27

210303
37 42 58.0 084 44 41.0
HERRINGTON LAKE
21167 KENTUCKY

11EPALES
3

2111202
0150 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
73/05/26	14	40 0000	23.3		60	225	8.90	95	0.060	0.600	0.440	0.026
	14	40 0005	21.7	13.6		225	8.90	94	0.040	0.600	0.420	0.019
	14	40 0015	18.7	7.2		250	8.00	96	0.130	0.500	0.650	0.043
	14	40 0030	17.1	4.4		245	7.70	95	0.170	0.500	0.980	0.103
	14	40 0050	15.9	5.4		265	7.60	106	0.120	0.500	1.040	0.091
	14	40 0070	13.5	5.8		260	7.60	103	0.040	0.500	1.040	0.085
	14	40 0100	11.8	7.0		280	7.60	114	0.030	0.400	1.040	0.072
	14	40 0145	9.7	2.2		280	7.50	117	0.140	0.500	1.090	0.066
73/08/20	14	00 0000	28.0	7.6	66	223	7.80	84	0.060	0.700	0.090	0.012
	14	00 0015	26.8	1.6		251	7.10	97	0.040	0.500	0.050	0.029
	14	00 0021	25.3			274						
	14	00 0030	23.0	0.2		236	6.80	101	0.240	0.800	0.320	0.118
	14	00 0060	18.3	0.2		203	6.70	97	0.040	0.400	0.700	0.093
	14	00 0090	16.6	0.2		201	6.60	98	0.130	0.600	1.180	0.105
	14	00 0129	15.2	0.0		268	6.40	150	1.620	2.700	0.120	0.066
73/10/24	11	54 0000	20.8		65	228	7.40	106	0.070	0.500	0.040	0.049
	11	54 0005	20.8	3.0		229	7.40	106	0.060	0.200	0.020	0.041
	11	54 0015	20.8	3.0		228	7.40	106	0.050	0.200	0.020	0.040
	11	54 0030	20.8	2.8		227	7.40	105	0.060	0.200	0.020	0.040
	11	54 0055	20.6	0.8		231	7.30	106	0.110	0.400	0.020	0.043
	11	54 0070	18.1	0.6		212	7.10	108	0.140	0.400	0.100	0.146
	11	54 0114	15.2	0.4		282	7.00					

STORET RETRIEVAL DATE 75/01/27

210303
37 42 58.0 084 44 41.0
HERRINGTON LAKE
21167 KENTUCKY

11EPALES 2111202
3 0150 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/05/26	14 40	0000	0.060	6.1
	14 40	0005	0.064	
	14 40	0015	0.070	
	14 40	0030	0.132	
	14 40	0050	0.108	
	14 40	0070	0.109	
	14 40	0100	0.080	
	14 40	0145	0.098	
73/08/20	14 00	0000	0.028	8.0
	14 00	0015	0.042	
	14 00	0030	0.139	
	14 00	0060	0.105	
	14 00	0090	0.219	
	14 00	0129	0.412	
73/10/24	11 54	0000	0.069	3.1
	11 54	0005	0.060	
	11 54	0015	0.057	
	11 54	0030	0.059	
	11 54	0055	0.072	
	11 54	0070	0.181	

STORET RETRIEVAL DATE 75/01/27

210304
37 40 16.0 084 41 24.0
HERRINGTON LAKE
21079 KENTUCKY

11EPALES
3

2111202
0034 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
73/05/26	15 40	0000	23.9		37	230	9.10	99	0.050	0.600	0.500	0.028
	15 40	0005	20.0	7.8		230	8.50	99	0.150	0.500	0.790	0.085
	15 40	0015	18.4	5.6		190	7.90	78	0.200	0.600	0.970	0.076
	15 40	0030	18.0	4.2		210	7.70	87	0.260	0.600	0.990	0.095
73/08/20	16 15	0000	27.9	5.8	40	236	7.80	94	0.060	1.000	0.060	0.012
	16 15	0005	27.5			244						
	16 15	0015	26.9	0.4		262	7.00	99	0.090	0.800	0.090	0.032
	16 15	0017	26.6			292						
	16 15	0023	24.7	0.1		318	6.70	134	0.720	1.500	0.080	0.089
73/10/25	12 21	0000	19.4		18	247	7.60	117	0.060	1.800	0.040	0.016
	12 21	0002	19.4	6.2		247	7.60	117	0.050	1.100	0.040	0.014
	12 21	0005	18.9	5.8		250	7.50	118	0.060	0.900	0.060	0.012

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/05/26	15 40	0000	0.125	16.2
	15 40	0005	0.145	
	15 40	0015	0.231	
	15 40	0030	0.224	
73/08/20	16 15	0000	0.044	11.0
	16 15	0015	0.075	
	16 15	0023	0.284	
73/10/25	12 21	0000	0.246	64.6
	12 21	0002	0.149	
	12 21	0005	0.140	

APPENDIX E

TRIBUTARY and WASTEWATER TREATMENT PLANT DATA

STORET RETRIEVAL DATE 75/01/13

2103A1 LS2103A1
37 47 00.0 084 42 00.0
DIX RIVER
21 7.5 WILMORE
O/HERRINGTON LAKE
BANK BELO DAM LIGHT DUTY DAM ACCESS RD
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO3&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/03/31	11 10		1.160	0.270	0.008	0.060	0.070
73/05/01	16 30		1.060	0.310	0.014	0.056	0.080
73/05/31	15 00		0.830	0.380	0.125	0.043	0.050
73/07/03	14 00		0.930	0.540	0.020	0.036	0.040
73/08/03	12 15		0.930	3.000	0.084	0.069	0.090
73/09/06	08 00		0.830	4.400	0.147	0.073	0.108
73/10/03	16 00		0.670	2.400	0.092	0.082	0.105
73/11/04	09 00		0.360	1.700	0.064	0.078	0.110
73/12/01	06 30		0.430	1.000	0.028	0.064	0.105
74/01/05	12 40		1.680	2.500	0.115	0.092	0.130
74/02/15	16 30		1.340	3.600	0.050	0.090	0.125
74/03/01	09 00		1.340	1.200	0.035	0.090	0.135
74/03/16	09 30		1.360	1.900	0.040	0.085	0.113
74/04/02	11 00		4.400	1.500	0.065	0.075	

STORET RETRIEVAL DATE 75/01/13

2103A3 LS2103A3
37 38 30.0 084 39 30.0
DIX RIVER
21 7.5 BRYANTSVILLE
T/HERRINGTON LAKE
HWY 52 BRDG NEAR GAGING STATION
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/03/31	09 00		0.790	0.420	0.020	0.042	0.085
73/05/01	12 30		1.100	0.190	0.009	0.037	0.075
73/05/30	14 30		0.960	0.560	0.044	0.050	0.145
73/07/03	08 30		1.100	1.890	0.230	0.070	0.205
73/08/01	13 00		0.980	2.000	0.069	0.078	0.160
73/08/31	11 00		0.020	1.200	0.039	0.079	0.150
73/10/02	09 30		0.037	0.900	0.048	0.052	0.110
73/10/31	10 12		0.132	2.500	0.048	0.052	0.095
73/12/31	10 15		1.760	0.700	0.036	0.060	0.135
74/01/05	09 30		1.520	0.700	0.080	0.065	0.090
74/03/01	12 30		1.200	0.800	0.075	0.080	0.120

STORET RETRIEVAL DATE 75/01/13

210381 LS2103B1
37 38 30.0 084 43 30.0
CLARKS RUN
21 7.5 BRYANTSVILLE
T/HARRINGTON LAKE
FORD ON RD 5 MI N OF ST HWY52
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO3&NO2 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/03/31	09 25		1.900	0.460	0.210	0.480	0.640
73/05/01	12 00		2.400	0.480	0.120	0.390	0.550
73/05/30	14 00		1.360	4.300	0.058	0.340	2.400
73/07/03	09 00		2.400	1.400	0.168	0.620	0.840
73/08/01	13 30		1.660	1.630	0.138	0.780	0.940
73/08/31	10 00		2.100	4.350	0.480	3.500	4.100
73/10/02	16 00		2.000	9.000	5.100	4.200	4.700
73/10/31	10 00		2.400	5.100	2.200	3.200	
73/12/31	10 35		3.700	0.800	0.096	0.152	0.300
74/01/31	10 00		3.300	2.100	0.440	0.360	0.520
74/03/01	13 00		2.660	1.500	0.400	0.620	0.880
74/04/02	10 00		2.200	1.500	0.090	0.180	0.530

STORET RETRIEVAL DATE 75/01/13

2103A3 LS2103A3
37 38 30.0 084 39 30.0
DIX RIVER
21 7.5 BRYANTSVILLE
T/HERRINGTON LAKE
HWY 52 BRDG NEAR GAGING STATION
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/03/31	09 00		0.790	0.420	0.020	0.042	0.085
73/05/01	12 30		1.100	0.190	0.009	0.037	0.075
73/05/30	14 30		0.960	0.560	0.044	0.050	0.145
73/07/03	08 30		1.100	1.890	0.230	0.070	0.205
73/08/01	13 00		0.980	2.000	0.069	0.078	0.160
73/08/31	11 00		0.020	1.200	0.039	0.079	0.150
73/10/02	09 30		0.037	0.900	0.048	0.052	0.110
73/10/31	10 12		0.132	2.500	0.048	0.052	0.095
73/12/31	10 15		1.760	0.700	0.036	0.060	0.135
74/01/05	09 30		1.520	0.700	0.080	0.065	0.090
74/03/01	12 30		1.200	0.800	0.075	0.080	0.120

STORET RETRIEVAL DATE 75/01/13

210331 LS2103B1
37 38 30.0 084 43 30.0
CLARKS RUN
21 7.5 BRYANTSVILLE
T/HARRINGTON LAKE
FORD ON RD 5 MI N OF ST HWY52
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/03/31	09	25	1.960	0.860	0.210	0.480	0.640
73/05/01	12	00	2.400	0.480	0.120	0.390	0.550
73/05/30	14	00	1.360	4.300	0.058	0.340	2.400
73/07/03	09	00	2.400	1.400	0.168	0.620	0.840
73/08/01	13	30	1.660	1.630	0.138	0.780	0.940
73/08/31	10	00	2.100	4.350	0.480	3.500	4.100
73/10/02	16	00	2.000	9.000	5.100	4.200	4.700
73/10/31	10	00	2.400	5.100	2.200	3.200	
73/12/31	10	35	3.700	0.800	0.096	0.152	0.300
74/01/31	10	00	3.300	2.100	0.440	0.360	0.520
74/03/01	13	00	2.600	1.500	0.400	0.620	0.880
74/04/02	10	00	2.200	1.500	0.090	0.180	0.530

STORET RETRIEVAL DATE 75/01/20

2103C1 LS2103C1
37 41 30.0 084 46 00.0
MOCKS BRANCH
21 7.5 DANVILLE
T/HERRINGTON LAKE
BRDG ON HWY 33 2.5 MI N OF DANVILLE
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P	50051 FLOW RATE INST MGD	50053 CONDUIT FLOW-MGD MONTHLY
73/03/31	10 30		2.000	0.320	0.013	0.132	0.210		
73/04/29	08 55		0.430	0.130	0.026				
73/05/01	12 30		1.760	0.480	0.011	0.095	0.150		
73/05/30	13 00		2.000	1.050	0.310	0.310	0.610		
73/07/03	09 30		2.100	8.500	0.870	0.200	0.315		
73/08/01	14 30		0.980	1.760	0.058	0.154	0.210		
73/08/31	09 30		0.490	2.100	0.205	0.220	0.345		
73/10/02	11 00		3.700	3.000	0.092	0.560	0.735		
73/10/31	09 00		1.000	1.850	0.184	0.368	0.520		
73/12/31	11 15		4.900	0.600	0.036	0.200	0.270		
74/01/31	11 00		4.200	1.100	0.030	0.165	0.230		
74/03/01	13 30		2.700	0.400	0.040	0.130	0.200		
74/04/02	09 00		2.300	1.700	0.040	0.250	0.830		

STORET RETRIEVAL DATE 75/01/20

210301
37 40 55.0 084 44 45.0
SPEARS CREEK
21 7.5 BRYANTSVILLE
T/LAKE HERRINGTON
BANK END OF SPEARS CREEK RD
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P	50051 FLOW RATE INST MGD	50053 CONDUIT FLOW-MGD MONTHLY
73/03/31	09 50		1.820	0.150	0.008	0.230	0.250		
73/04/29	11 00		1.780	0.200	0.020	0.210	0.250		
73/05/30	13 30		0.720	1.150	0.058	0.110	0.250		
73/07/03	09 00		0.033	1.050	0.044	0.026	0.095		
73/08/01	14 30		0.010	1.150	0.085	0.028	0.090		
73/08/31	08 30		2.200	1.760	0.100	0.350	0.390		
73/10/02	10 30		2.300	6.000	0.150	0.400	0.575		
73/10/31	09 30		1.120	0.500	0.028	0.336	0.380		
73/12/31	11 00		3.600	0.500	0.036	0.264	0.345		
74/01/31	10 30		2.400	0.500	0.015	0.175	0.220		
74/03/01	13 25		2.500	0.300	0.012	0.230	0.300		
74/04/02	09 30		2.100	1.100	0.030	0.290	0.780		

STORET RETRIEVAL DATE 75/01/13

2103E1
37 45 15.0 084 44 25.0
CANE RUN
21 7.5 WILMORE
T/LAKE HERRINGTON
BANK 3 MI SE OF BURGIN
11EPALES 2111204
0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/03/31	13	30	2.040	0.440	0.022	0.220	0.290
73/04/29	10	00	2.200	0.100K	0.012	0.210	0.260
73/05/31	16	00	2.400	0.440	0.115	0.231	0.340
73/07/03	14	00	2.700	0.540	0.026	0.273	0.410
73/08/03	14	00	1.540	0.100K	0.026	0.245	0.280
73/09/06	11	00	0.400	0.440	0.073	0.336	0.380
73/10/03	14	00	0.330	0.550	0.075	0.420	0.500
73/11/04	09	20	1.090	2.400	0.216	0.320	0.390
74/01/05	12	00	3.400	0.300	0.015	0.250	0.315
74/02/15	16	00	1.600	2.200	0.050	0.120	0.160
74/03/01	10	00	2.100	4.400	0.090	0.230	0.390

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STORET RETRIEVAL DATE 75/02/03

2103AA TF2103AA P003446
37 36 50.0 084 35 10.0
LANCASTER
21 7.5 LANCASTER
1/HERRINGTON LAKE
#HITE OAK CREEK/DIX RIVER
11EPALES 2141204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P	50051 FLOW RATE INST MGD	50053 CONDUIT FLOW-MGD MONTHLY
73/04/19	11 00								
CP(T)-			4.300	27.000	3.400	20.400	23.000	0.220	0.200
73/04/19	16 00								
73/05/09	11 00								
CP(T)-			5.100	14.700	0.550	15.200	19.500	0.300	0.200
73/05/09	16 00								
73/06/12	08 00								
CP(T)-			9.200	14.000	5.340	18.900	24.000	0.280	0.269
73/06/12	16 00								
73/07/16	08 00								
CP(T)-			5.500	24.000	7.800	7.800	20.500		0.224
73/07/16	16 00								
73/09/16	11 00								
CP(T)-			6.600	42.000	24.700	15.200	18.000	0.180	0.199
73/09/16	16 00								
73/10/22	11 00								
CP(T)-			5.200	24.000	9.800	42.250	50.000	0.170	
73/10/22	16 00								
73/11/18	11 00								
CP(T)-			6.600	39.000	21.000	12.600	17.300	0.160	0.184
73/11/18	16 00								
74/02/04	10 30								
CP(T)-			0.160	10.000	1.600	6.600	9.100	0.200	0.288
74/02/04	15 30								
74/03/04	10 00								
CP(T)-			5.040	17.000	4.400	8.500	11.500	0.190	0.200
74/03/04	16 00								
74/04/05	09 30								
CP(T)-			5.200	12.000	2.100	7.200	10.500	0.300	0.271
74/04/05	11 30								
74/05/01	09 20								
CP(T)-			8.400	24.000	10.000	5.900	17.300	0.250	0.255
74/05/01	11 20								
74/06/03	09 00								
CP(T)-			4.500	14.000	4.700	5.400	8.000	0.370	0.214
74/06/03	11 00								

STORET RETRIEVAL DATE 75/02/03

2103AA TF2103AA P003446
37 36 50.0 084 35 10.0
LANCASTER
21 7.5 LANCASTER
T/HERRINGTON LAKE
WHITE OAK CREEK/DIA RIVER
11EPALES 2141204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P	50051 FLOW RATE INST MGD	50053 CONDUIT FLOW-MGD MONTHLY
74/07/02	09	30							
CP(T)-			0.320	23.000	14.000	30.000	30.000	0.250	0.225
74/07/02	11	30							

STORET RETRIEVAL DATE 75/02/03

2103AB IF2103AB P002474
37 30 00.0 084 39 30.0
STANFORD
21 7.5 DANVILLE
T/HERRINGTON LAKE
LOGAN CREEK/DIX RIVER
11EPALES 2141204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P	50051 FLOW RATE INST MGD	50053 CONDUIT FLOW-MGD MONTHLY
73/04/18	11	00							
CP(T)-			1.370	12.400	0.370	5.800	9.200	0.275	0.253
73/04/18	16	00							
73/05/21	11	00							
CP(T)-			1.260	18.000	3.200	4.700	9.100	0.268	0.275
73/05/21	16	00							
73/06/21	11	00							
CP(T)-			0.860	13.000	2.600	3.200	7.700	0.287	0.273
73/06/21	16	00							
73/07/24	11	00							
CP(T)-			0.840	11.500	0.260	5.100	11.000	0.265	0.287
73/07/24	16	00							
73/08/16	11	00							
CP(T)-								0.287	0.269
73/08/16	16	00							
73/09/19	11	00							
CP(T)-			1.100	19.000	7.900	7.800	11.500	0.528	0.379
73/09/19	16	00							
73/10/25	11	00							
CP(T)-			5.200	8.300	0.420	10.800	11.500	0.487	0.370
73/10/25	16	00							
73/12/06	11	00							
CP(T)-			3.990	7.100	1.300	14.000	17.300	0.496	0.484
73/12/06	16	00							
74/01/08	11	00							
CP(T)-			2.760	7.400	0.150	2.100	4.800	0.487	0.371
74/01/08	16	00							
74/02/07	11	00							
CP(T)-			1.760	7.000	2.160	1.900	3.700	0.792	0.380
74/02/07	16	00							
74/02/26	11	00							
CP(T)-			2.400	9.800	0.570	14.000	18.800	0.734	0.489
74/02/26	16	00							
74/03/27	23	00							
CP(T)-			1.480	5.000	0.540	2.300	4.600	0.384	0.297
74/03/28	04	00							

STORET RETRIEVAL DATE 75/02/03

21038A TF21038A P011542
37 37 55.0 084 45 40.0
DANVILLE
21 7.5 DANVILLE
T/HERRINGTON LAKE
CLARKS RUN
11EPALES 2141204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P	50051 FLOW RATE INST MGD	50053 CONDUIT FLOW-MGD MONTHLY
73/04/24	08 00								
CP(T)-			6.800	6.000	0.340	2.800	3.900	1.700	1.600
73/04/24	16 00								
73/05/30	08 00								
CP(T)-			6.500	6.000	0.041	1.580	3.600	1.800	1.600
73/05/30	16 00								
73/06/25	08 00								
CP(T)-			1.740	12.600	1.160	6.900	8.800	1.600	1.600
73/06/25	16 00								
73/07/30	08 00								
CP(T)-			7.200	11.000	0.440	5.000	6.300	1.600	1.600
73/07/30	16 00								
73/08/27	08 00								
CP(T)-			7.600	16.000	1.140	9.200	14.700	1.600	1.600
73/08/27	16 00								
73/09/28	08 00		11.600	7.900	1.000	11.000	11.500	1.400	1.600
73/10/29	08 00								
CP(T)-			10.000	18.000	4.500	5.900	9.450	1.600	1.600
73/10/29	16 00								
73/11/28	08 00								
CP(T)-			8.600	5.200	0.240	1.600	3.000	1.600	1.600
73/11/28	16 00								
73/12/27	08 00								
CP(T)-			6.160	4.300	0.100	1.470	1.850	1.600	1.600
73/12/27	16 00								
74/01/27	08 00								
CP(T)-			4.900	8.600	0.120	3.700	4.400	1.600	1.600
74/01/27	16 00								
74/02/27	08 00								
CP(T)-			3.700	10.000	0.062	2.600	3.500	1.600	1.600
74/02/27	16 00								
74/03/28	08 00								
CP(T)-			4.000	9.000	0.350	3.600	6.700	1.600	1.600
74/03/28	16 00								
74/04/30	08 00								
CP(T)-			5.600	15.000	1.600	5.500	7.800	1.600	1.600
74/04/30	16 00								

5/6